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# MANAGING FORESTED WATERSHEDS

*Cooperative Programs  
for Water Resource  
Conservation*

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# MANAGING FORESTED WATERSHEDS

Cooperative  
Programs  
for  
Water  
Resource  
Conservation

Trees, water, soil, working in harmony, bring many benefits to mankind. Here, seasonal snowmelt from a well-managed watershed assures a plentiful supply of pure water. FS-499693



**B**Y THE YEAR 2000, the amount of water needed by municipalities is expected to double, and that needed for manufacturing to quadruple. Eight million more acres of land will be required for reservoirs. Irrigation withdrawals of water will increase 50 percent.

The Nation's water supply is generally considered adequate for the present, but even today, water of desired quality is not always available where and when it is needed most. Too often, unwise land practices and man's poor "housekeeping" habits have caused or accentuated floods, erosion, seasonal water shortages, pollution by organic and inorganic wastes, and reduction of ground water.

Floods and droughts are opposite sides of the same coin. Floods deliver vast amounts of runoff water that is lost to man's use and often results in loss of life and property. During periods of drought, farmers may be faced with failing crops and with hauling water for livestock, while the city dweller and industrial user find restrictions in daily use of their water supply. Watershed management measures such as land treatment, small upstream structures, and stream-channel stabilization can help to control flood runoff and improve water retention.

Meeting the problems of today and the needs of the future in providing adequate and dependable water supplies requires the full cooperation of Federal and State governments, private landowners, industry, and the American public. The Forest Service, acting cooperatively with the State forestry organizations, provides leadership for the forestry phases of a watershed program carried out under the administrative responsibility of the Soil Conservation Service. This publication describes Forest Service activities in that program.

## PROGRAMS AND ACTIVITIES

### Opportunities

Of the Nation's 489 million acres of commercial forest land, 358 million acres, or 73 percent, is in private ownership. Of this, 165 million acres (46 percent) is in farms, 131 million acres (36 percent) is in other private holdings, and 62 million acres (17 percent) is owned by forest industries. These forested lands produce over 60 percent of the total water yield in the United States and play a vital role in maintenance of water quality. Yet, these same lands are expected to provide a wide range of other goods and services. Challenging opportunities lie in integrating these diverse uses and ever-increasing demands with the production of adequate water supplies.

Such a challenge is to bring about better multiple-use management of 10 million acres of forested land which involves more than 2,000 municipal and county watersheds. In the Northeastern States alone, there are more than a million acres of forested land contributing to over 400 municipal reservoirs. Here water is the most important product, and the main objective of management in these areas is the production of potable and palatable water. Dur-



Poor land use created severe gullies and erosion, rapid runoff, and dirty water. The land is now nonproductive. FS-441217

ing the past 20 years, some degree of management has been initiated on these properties; however, it is estimated that more than 90 percent of the job still remains to be done. There are many other opportunities to protect and enhance the water resource through multiple-use management, whether it is on large industrial timberlands, farm woodlots, or private recreation and hunting areas.

### Programs

Watershed management of privately owned woodland is supported by several programs of the Department of Agriculture. In addition to technical advice and assistance to private owners, there are the Small Watershed Program (P. L. 83-566), the River Basin Studies and Investigations Program, the Flood Prevention Program, and Emergency Flood Prevention Program.

*Small Watershed Program.*—Land improvement on a watershed is of direct concern to the people most involved—those who live on and own the land. Work under the Small Watershed Program is based on the theory that watershed management can best be done on community-size watersheds. This group effort is most important in assisting upstream land treatments to help minimize downstream flooding and sedimentation. The program provides for structural and land treatment measures to solve local land and water problems. But the real initiative comes from the people who provide the impetus by forming local interest groups, Soil and Water Conservation District organizations, or watershed associations to ask for Federal assistance.

Assistance in the forestry phases of the program is carried out in cooperation with State Foresters. This includes making surveys, preparing plans, and installing land treatment measures to reduce flood runoff and sediment production.

*River Basin Studies And Investigations Program* (comprehensive river basin planning).—Planning under this program involves cooperation with other Federal and State agencies for the conservation, development, and utilization of water and related land resources. Studies and reports are coordinated through the Water Resources Council (established by the Water Resources Planning Act) and are aimed at ensuring that operations on small watersheds are geared to the needs of an entire basin. They determine the effects, needs, and impacts that forest lands may have through basin-wide planning. Included are studies on the significance of the forest resource in the total economy, present and future conditions of forested lands, their effects on the water regime, and needs for treatment and development.

*Flood Prevention Program.*—One of the older cooperative programs, known as the Flood Prevention Program, provides for the protection, restoration, and improvement of forest land resources in 11 authorized watersheds where land and water resource problems were critical. The Yazoo and Little Tallahatchie Watersheds in northwest Mississippi are examples of such Flood Prevention Projects. Here thousand of acres of overcut, overgrazed, and

**Reforestation has stopped erosion of the soil and has created a favorable ground condition for infiltration and storage of ground water. This land is also growing a valuable crop of timber. FS-476619**



burned forest lands are being returned to productivity primarily for flood prevention and soil stabilization purposes.

*Emergency Flood Prevention Program.*—A third water resource program provides for the emergency treatment of watershed lands that have been impaired by fire, flood, or other disaster. The Forest Service works cooperatively with the Soil Conservation Service, local citizens, the State Forester, and other State agencies in planning and installing emergency measures for runoff retardation and soil erosion prevention. Such measures are needed to safeguard lives and property from floods and the products of erosion.

### Planning

Watersheds and River Basins are studied with respect to flood and sediment damage, causes of erosion, and measures needed for protection and correction. This involves an assessment of climatic, geologic, physiographic, vegetative, and economic factors. The services of several different skills and professions, such as foresters, soil scientists, hydrologists, engineers, land-resource economists, and watershed planners are required.

Working as a team, these specialists conduct a surey and analysis to de-

A complementary program of forest management with dam construction often provides flood prevention, plentiful water supplies, fish and wildlife benefits, water-based recreation, and valuable timber. SCS-IND.-60536



velop a plan for forest and related open land treatment in the watershed or river basin. This is complemented by a plan for structural improvements involving dams and channels developed by the Soil Conservation Service.

### **Assistance**

Another phase of a watershed management program involves the installation of improvements as set forth in an approved work plan. Each woodland owner in an area involved in such a plan is contacted and informed of the project status. His support and participation are invited.

If the owner so desires, a watershed management plan will be prepared as supplement to the basic conservation plan for his woodland holdings. A forester will examine the woodland and recommend appropriate watershed measures, such as skid-trail stabilization, tree planting, improvement cutting, and other actions needed to create a stable, productive watershed. This plan will show where the treatments are needed, their specifications, and costs.

The forester will also provide technical advice and guidance and suggest where financial assistance can be obtained.

Technical services for the examination and development of a watershed management plan for the woodland will be provided at no cost to the owner. The services are a cooperative endeavor which involves a number of Federal and State agencies. Financial assistance for installing the measures may be obtained from the Agricultural Stabilization and Conservation Service and Farmers Home Administration. Guidance and assistance are provided the owner by State Forestry Departments who actively participate and assist in planning the forestry phase of the program.

## **LAND USE AND TREATMENT**

To obtain steady flows of high quality water and minimize floodwater runoff, forested watershed lands must be managed toward two major water resource goals—Protection and Improvement.

Protection and improvement of the water resource begin with the land—how it is used, how it is managed and treated. The effectiveness and life expectancy of dams, reservoirs, and other engineering works are enhanced by good land management on upstream watersheds.

### **Protection**

If properly managed, forested lands provide excellent protection for the water resource. The effect begins before raindrops hit the ground. Twigs, branches, leaves, and needles intercept the raindrops and reduce the force of impact on the ground. Forest litter under the trees takes up the rest of the impact, making it easy for the water to move to the soil beneath, thus preventing soil loss or movement.

Soil under a well-managed forest absorbs water better than similar soils in



**Most forest fires are caused by human carelessness.** FS-501015



**They sometimes devastate valuable watersheds.** FS-405677

other land uses. Its surface is usually made up of a spongy humus. Beneath this porous surface, the soil's texture has been loosened by roots and organisms found only under living vegetation. Thus, forested areas are able to catch and hold rainwater while it percolates slowly to the soil layers that replenish surface streams, and to the deeper soil strata that serve as underground reservoirs.

Excessive demands upon forest lands for timber, recreation, forage, and minerals, or the destruction caused by forest fires, can damage or destroy such lands as a source of palatable water. Protection, therefore, is an important factor in water-resource management. Timber stands must be harvested in such a way as to minimize soil loss and prevent sediment in streams; roads and other developments must be designed, built, and maintained to sound standards; adequate fire-prevention and suppression measures must be taken; and the intensity of grazing must be closely observed to avoid soil compaction and maintain a good protective cover.

Sediments are a major problem to both water quality and flood control. On forested land, soil washes into streams from logging roads, skid trails, grazed woodland, eroding streambanks, and burned-over lands. Two approaches to the sedimentation problem are possible: *First*, prevention through proper management, harvesting procedures, and protection techniques applied on both private and public lands. Sediment control is most effective at its source. *Second*, scientific rehabilitation of critical areas including better and more efficient use of soil and water. Practices designed to provide effective ground cover and to improve infiltration of water will insure efficient water conservation and avoid excessive soil loss.

### **Improvements**

If for any reason a watershed has deteriorated, the cause of damage must be reduced or terminated. It is then necessary to establish a good protective



ture to divert surface water and plant soil-  
ling vegetation after logging caused this  
d scar. Reclamation will be costly.

FS-484268



This road was anchored with Ladino clover  
and orchard grass after tree harvest. Results:  
stable soil, clear streams, food for wildlife.

FS-471008

covering of vegetation, which may first require such mechanical measures as small dams, diversions, terraces, or furrows. These measures are designed to help keep soil in place, reduce sedimentation, and improve water quality.

Management of a forested watershed is also directed toward improving the potential water yield of a particular area. In areas of deep snowpack, it has been found that streamflow may be increased by cutting the forest in special patchwork or strip patterns. Snow reaching the ground melts slowly in the spring and fewer trees use the water stored in the soil. The patches of uncut trees protect the cut areas against wind and sun and prevent rapid runoff and erosion.

In the Southwest, flood plains and banks of many streams support dense stands of high water-consuming plants with roots tapping the ground water. These deep-rooted plants, called *phreatophytes*, meaning "well plant" can be replaced with shallow-rooted grasses that make less demand upon the water supply.

In areas where most of the precipitation occurs in the form of rain, the distribution of water yields may be altered by the removal of trees. Through judicious tree cutting, an area can be made to give up some of its water. This is a delicate procedure requiring highly trained watershed specialists, for the trees must be removed carefully without damaging the forest floor.

### Technical Requirements

Forest Service scientists are continually finding new breakthroughs in knowledge that will improve the quality, quantity, and distribution of streamflow. A comprehensive research program is underway at eight Regional Forest Service Experiment Stations across the Nation. Watershed hydrologists, economists, and planners in flood prevention and river basin activities are developing new techniques for applying the basic data developed by Forest Service scientists in cooperation with States, universities, industries, and

other Federal agencies.

In the long history of conservation, there have been few total solutions or panaceas for natural resource problems. Present knowledge must be applied to immediate situations and research must seek out new developments and techniques. But for the foreseeable future, wise management and application of existing technical knowledge will be the tools of the forest manager in making a real and meaningful contribution toward solving persistent water problems. More advances will be forthcoming as greater public awareness of the need continues to develop.

## CHALLENGES AND THE JOB AHEAD

There can be no doubt that increasing population and expanding economy will place greater demands on our water supply. The use of water by lumber, plywood, and related forest product industries is relatively modest, but others require large amounts of high-quality water. In turn, disposition of the effluent and waste products from certain industries presents formidable problems.

How serious our water problems will be in the year 2000 depends upon the actions taken now for water resource development and to alleviate waste and pollution. Of the many possible approaches to these problems, the basic approach on forested areas must be through improved management of forested watersheds so that they will catch, hold, and release high quality water at a desired rate.

The creation of numerous Regional and River Basin commissions throughout the country, and the enactment of legislation for water development and water pollution control, attest to the importance now being placed on watershed management. Although watershed management on forest land is now recognized as a vital part of the Nation's water resource development programs, the task of planning and applying such practices is still to be undertaken on a realistic scale.

Surveys on more than 800 small watershed projects covering over 13 million acres of land have been completed. The U.S. Department of Agriculture has participated in more than 50 river-basin surveys, and more are underway. There are now several outstanding examples of successful rehabilitation of badly damaged watersheds.

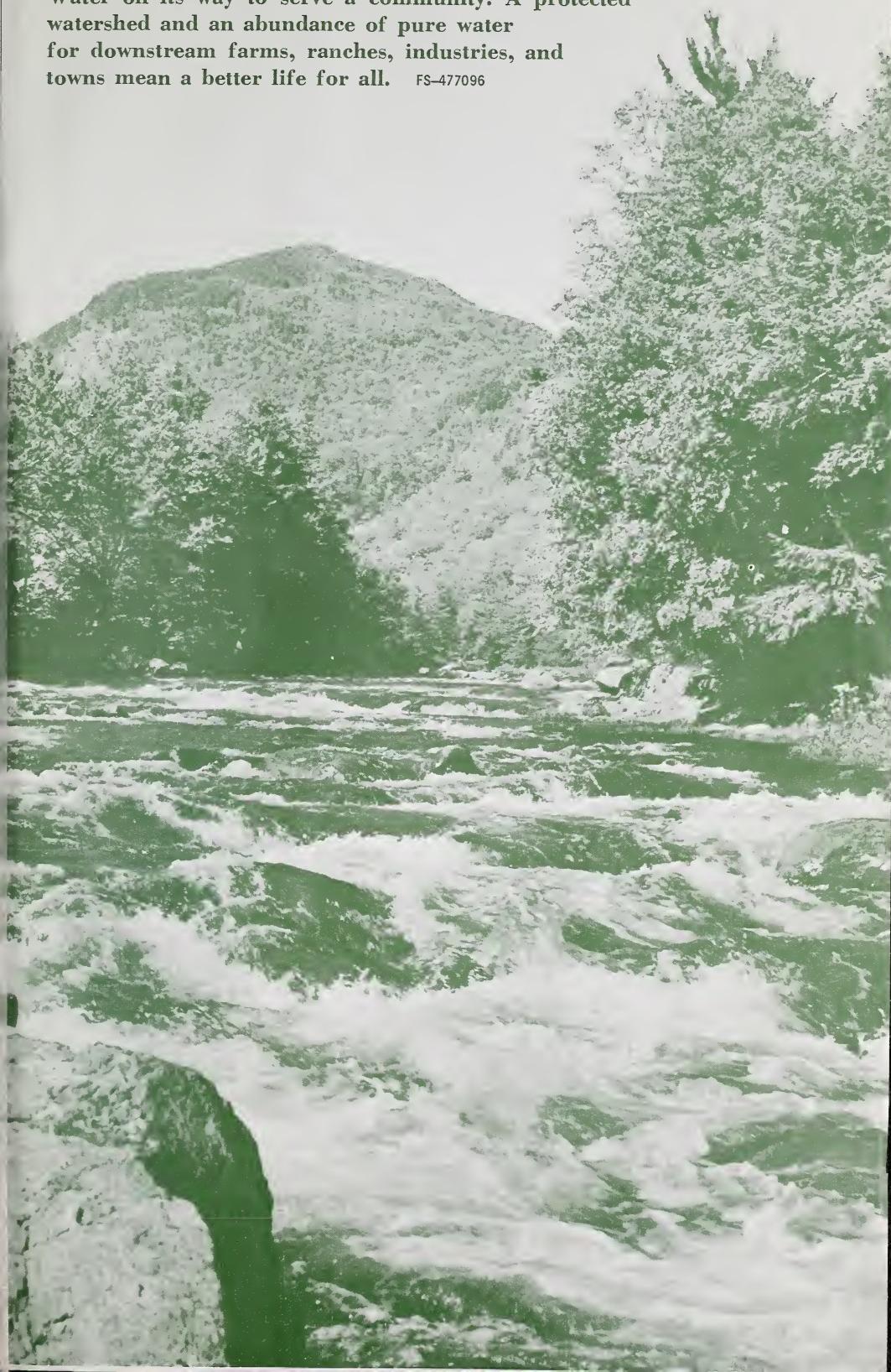
The Forest Service and the State Forestry agencies, often in cooperation with private landowners, work together to assure the Nation a plentiful supply of high quality water. This booklet has described the kinds and importance of cooperative watershed programs. These are, however, barely a start on the very large task that remains to be done.

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**Water on its way to serve a community. A protected watershed and an abundance of pure water for downstream farms, ranches, industries, and towns mean a better life for all.** FS-477096





## ABOUT THE FOREST SERVICE . . . . .

As our Nation grows, people expect and need more from their forests—more wood; more water, fish, and wildlife; more recreation and natural beauty; more special forest products and forage. The Forest Service of the U.S. Department of Agriculture helps to fulfill these expectations and needs through three major activities:

- Conducting forest and range research at over 75 locations ranging from Puerto Rico to Alaska to Hawaii.
- Participating with all State forestry agencies in cooperative programs to protect, improve, and wisely use our country's 395 million acres of State, local, and private forest lands.
- Managing and protecting the 187-million-acre National Forest System.

The Forest Service does this by encouraging use of the new knowledge that research scientists develop; by setting an example in managing, under sustained yield, the National Forests and Grasslands for multiple use purposes; and by cooperating with all States and with private citizens in their efforts to achieve better management, protection, and use of forest resources.

Traditionally, Forest Service people have been active members of the communities and towns in which they live and work. They strive to secure for all, continuous benefits from the country's forest resources.

For more than 60 years, the Forest Service has been serving the Nation as a leading natural resource conservation agency.